CLAIMS

We claim:

1.   A device for performing surgery or therapeutic interventions on a patient, comprising:

    a first curvature sensor configured to be placed on a patient, the first curvature sensor

5   providing an output;

    an attachment fixture coupled to the first curvature sensor; and

    a computer receiving the output of the curvature sensor.

2.   The device of claim 1 wherein the first curvature sensor further comprises a plurality

of fiducials capable of being detected by a medical imaging system.

10   3.   The device of claim 1, further comprising:

    a second curvature sensor providing an output to the computer, the second curvature

sensor having a first end and a second end and capable of being coupled to the attachment

fixture at the first end; and

    a tool connector coupled to the second end of the second curvature sensor.

15   4.   The device of claim 3, further comprising a second attachment fixture capable of

being positioned at a known location with respect to the first curvature sensor, wherein the

second end of the second curvature sensor is coupled to the second attachment fixture and the

tool connector is coupled to the second curvature sensor between the first end and the second

end.

20   5.   The device of claim 3, further comprising a monitor for positionally displaying the

tool connector with respect to the patient.

6.   The device of claim 3, further comprising an electronic interface device coupled to the

first curvature sensor and electronically coupled to the computer.

7.   The device of claim 3, further comprising an optical tracking system electronically

25   coupled to the computer and configured to positionally track the tool connector or a tool

positioned in the tool connector.

8.   The device of claim 7, wherein the computer uses both the second curvature sensor

and the optical tracking system to positionally track the tool connector or a tool positioned in

the tool connector.

9.   The device of claim 1, wherein the computer is configured to determine an attachment fixture-centered frame of reference based on the output of the curvature sensor.

10.   The device of claim 1, wherein the first curvature sensor comprises a fiber optic curvature sensor.

11.   The device of claim 1, wherein the attachment fixture comprises:

at least one fiducial; and

a latching mechanism configured for attaching to the first end of the second curvature sensor.

12.   A device for performing surgery or therapeutic intervention on a patient, comprising:

an attachment fixture;

at least one fiducial coupled to the attachment fixture, the fiducial being capable of being detected by a medical imaging system;

a curvature sensor having a first end and a second end and capable of being coupled to the attachment fixture at the first end;

a tool connector coupled to the second end of the curvature sensor; and

a computer electronically coupled to the curvature sensor.

13.   A device for use in an image guided therapy or image guided surgery system, comprising:

a curvature sensor configured to be applied to a portion of a patient, the curvature sensor being adapted to measure and provide an output of the curvature the portion of the patient; and

an attachment fixture coupled to the curvature sensor, the attachment fixture comprising a fiducial.

14.   The device for use in an image guided therapy or image guided surgery system according to claim 13, further comprising a plurality of fiducials coupled to the curvature sensor.

15.   The device for use in an image guided therapy or image guided surgery system according to claim 13, wherein the curvature sensor comprises a fiber optic curvature sensor.

16.   A device for generating a patient-based frame of reference for an image guided therapy or image guided surgery system, comprising:

    a curvature sensor configured to be applied to a portion of a patient, the curvature sensor being adapted to measure and provide an output of the curvature the portion of the patient; and

    an attachment fixture coupled to the curvature sensor at a known position with respect to the curvature sensor.

17.   A device for generating a patient-based frame of reference for an image guided therapy or image guided surgery system according to claim 16, further comprising a plurality of fiducials, each fiducial of the plurality of fiducials being coupled to the curvature sensor at known inter-fiducial distances.

18.   A device for generating a frame of reference for an image guided therapy or image guided surgery system, comprising:

    a ribbon, the ribbon being comprised of one or a combination of plastic, metal wire, metal strip, fabric, rubber, synthetic rubber, nylon, thread, glass, or paper;

    a plurality of fiducials attached at known inter-fiducial distances along the ribbon; and

    an attachment fixture coupled to the ribbon at a known position with respect to the plurality of fiducials.

19.   A sensing mesh, comprising:

    at least one curvature sensor; and

    a plurality of filaments coupled to the plurality of curvature sensors.

20.   The sensing mesh of claim 19, further comprising a plurality of fiducials coupled to the at least one curvature sensor.

21.   The sensing mesh of claim 19, further comprising a plurality of fiducials coupled to the plurality of filaments.

22.   A sensing mesh according to claim 19, wherein the sensing mesh is configured as a garment.

23.   The sensing mesh according to 22, wherein the garment comprises a cap.

24.   The sensing mesh according to 22, wherein the garment is configured to fit a human pelvic region.

25.   The sensing fabric according to claim 22, wherein the garment is configured to fit a human torso.

5   26.   A system for monitoring or enabling surgery on a patient at a distance, comprising:

    a first curvature sensor configured to be placed on the patient, the first curvature sensor providing an output;

    an attachment fixture attached to the first curvature sensor;

    a second curvature sensor having a first end and a second end and capable of being

10   coupled at the first end to the attachment fixture, the second curvature sensor providing an output;

    a tool capable of being coupled to the second end of the second curvature sensor;

    a computer receiving the outputs of the first curvature sensor and the second curvature sensor and adapted to provide an output of the curvature of the first curvature sensor and the

15   position and orientation of the tool coupled to the second end of the second curvature sensor with respect to the attachment fixture; and

    a communication device electronically coupled to the computer and adapted to communicate the output of the computer to a distant receiver.

27.   A device for monitoring the motions of a body, comprising:

20   a garment configured to be applied to a body, the garment comprising,

        at least one curvature sensor, and

        a plurality of filaments coupled to the plurality of curvature sensors to form a mesh; and

    a communication device configured to communicate the output of the curvature

25   sensors to a distant receiver.

28.   A method of locating fiducials within an image of a patient produced by a medical imaging system, comprising the steps of:

    placing an array of fiducials on the patient, each fiducial within the array of fiducials being located at known inter-fiducial distances apart from one another;

30   imaging the patient with a medical imaging system to obtain an image;

        identifying and locating in the image a reference point on the array of fiducials;

inspecting the image one inter-fiducial distance from the reference point and identifying a fiducial using an image recognition means, the identified fiducial becoming a last-identified fiducial;

inspecting the image one inter-fiducial distance from the last-identified fiducial and

5   identifying a next fiducial using an image recognition means, the identified next fiducial then becoming a last-identified fiducial; and

repeating the previous step until all fiducials within the array of fiducials have been identified in the image.

29.   A method of registering a patient to an image produced by a medical imaging system,

10   comprising the steps of:

placing a curvature sensor on the patient, the curvature sensor configured to produce a signal corresponding to the three-dimensional shape of the curvature sensor and comprising at least one fiducial;

imaging the patient using a medical imaging system to produce an imaging study;

15   analyzing the imaging study to create a data set in a computer database, the data set including identification of the at least one fiducial on the curvature sensor;

electronically connecting the computer to the curvature sensor;

determining the three-dimensional shape of the curvature sensor by using the computer to analyze the signal produced by the curvature sensor; and

20   correlating the volumetric data set in the computer database to the three-dimensional shape of the curvature sensor by identifying the position of the at least one fiducial as a common point in a frame of reference.

30.   A method for conducting surgery or therapeutic intervention on a body, comprising the steps of:

25   placing a first curvature sensor on the body, the first curvature sensor comprising at least one fiducial in a known position with respect to the first curvature sensor;

conducting an imaging study of the body using a medical imaging system, the imaging study recording the position of the at least one fiducial with respect to the body;

processing the imaging study to create an image data set and storing the image data

30   set in a computer, the data set including the position of the at least one fiducial with respect to the body;

connecting the first curvature sensor to the computer and using the first curvature sensor information to register the first curvature sensor and the at least one fiducial to the image data set;

coupling one end of a second curvature sensor to the body at a known position and

5   orientation with respect to the at least one fiducial and coupling a surgical or therapeutic tool to the other end of the second curvature sensor;

displaying an image of the body from the image data set superimposed with an image of the position and orientation of the surgical or therapeutic tool with respect to the body; and

using the superimposed image of the surgical or therapeutic tool on the image of the

10   body to guide the surgical or therapeutic tool.

31.   A device for conducting surgery or therapy on a body, comprising:

means for measuring the curvature of a body;

means for locating the position of the means for measuring the curvature of a body within a frame of reference;

15   means for determining the position of a tool with respect to the means for measuring the curvature of a body; and

means for registering a volumetric image of the body to the means for measuring the curvature of a body.

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